

catheter having a tubular shaft that forms a majority of the length of the catheter and a tip portion comprising the suction port. The tip portion is connected at the distal end of the shaft with an aspiration lumen extending from a suction device to the aspiration port. Also, in some embodiments, the tip portion is curved to position the suction port adjacent to a vessel wall within a distance of the vessel wall that is no more than about 10 percent of the vessel diameter. In additional embodiments, the tip portion has a displacement across the vessel at least as large as the vessel diameter such that a section of the tip portion contacts the vessel wall.

[0012] In other aspects, the invention pertains to a thrombectomy catheter comprising a suction device, a proximal portion fluidly connected to the suction device, a tubular shaft attached at its proximal end to the proximal portion, a tip portion at the distal end of the tubular shaft with a continuous suction lumen from the proximal portion to the tip portion, and a partially occluding structure. In some embodiments, the partially occluding structure can comprise a flap that extends outward from other portions of the catheter or a balloon that extends only partially around the circumference of the catheter. The tip portion comprises a suction port in fluid communication with the suction lumen.

[0013] Furthermore, the invention pertains to a method for removing thrombus from a vessel of a patient. The method comprises aspirating fluid from the vessel through a suction port in a thrombectomy catheter having a tubular shaft that forms a majority of the length of the catheter and a tip portion comprising the suction port. The tip portion is connected at the distal end of the shaft with an aspiration lumen extending from a suction device to the aspiration port. Flow is partially occluded with a partial occlusion structure that extends from the outer diameter of the catheter.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] FIG. 1 is a fragmentary side view of a thrombectomy catheter with a curved tip portion.

[0015] FIG. 2 is a fragmentary side view of the distal end of a thrombectomy catheter with a rapid exchange segment.

[0016] FIG. 3A is a fragmentary side view of the distal end of a thrombectomy catheter with a suction port at its distal end.

[0017] FIG. 3B is a fragmentary side view of a distal end of a thrombectomy catheter with a suction port at its distal end having an angled opening relative to its lumen.

[0018] FIG. 4A is a fragmentary side view of a rapid exchange thrombectomy catheter with a suction port at its distal end and an angled opening.

[0019] FIG. 4B is a fragmentary side view of the rapid exchange aspiration catheter of FIG. 4A shown with the guide structure separated from the aspiration catheter.

[0020] FIG. 4C is a fragmentary side view of the distal end of the rapid exchange catheter of FIG. 4A shown with a loading tool facilitating the loading of the guide structure within the rapid exchange port.

[0021] FIG. 4D is a side view of an alternative embodiment of a loading tool.

[0022] FIG. 4E is a fragmentary side view of the distal end of the rapid exchange catheter of FIG. 4A shown with the loading tool of FIG. 4D.

[0023] FIG. 4F is a sectional view of the catheter and loading tool of FIG. 4E taken along line F-F of FIG. 4E.

[0024] FIG. 5 is a fragmentary side view of a distal end of a curved tip of a thrombectomy catheter with displacement distance "D" marked appropriately.

[0025] FIG. 6A is a fragmentary side view of an embodiment of the distal end of a thrombectomy catheter with a distal guide lumen and a guide structure extended through the distal guide lumen to hold the tip in a delivery configuration.

[0026] FIG. 6B is a fragmentary side view of the distal end of a rapid exchange embodiment of a thrombectomy catheter with a distal guide lumen.

[0027] FIG. 6C is a fragmentary side view of the distal end of a thrombectomy catheter with a distal guide lumen that also functions as a rapid exchange segment.

[0028] FIG. 7A is a fragmentary side view of the thrombectomy catheter of FIG. 6 with the tip in a curved configuration with the distal guide lumen free of the guide structure.

[0029] FIG. 7B is a fragmentary side view of the thrombectomy catheter of FIG. 6 with a guide structure having blades suitable to free the guide structure from the distal lumen. The insert shows an expanded view of the guide structure in the vicinity of the blades.

[0030] FIG. 8 is a fragmentary side view of the thrombectomy catheter of FIG. 6 with the tip in a curved configuration due to the guide structure being positioned with a flexible portion at the catheter tip.

[0031] FIG. 9A is a side view of an alternative embodiment of a thrombectomy catheter with an obturator maintaining the tip in a delivery configuration.

[0032] FIG. 9B is a side view of the thrombectomy catheter of FIG. 9A with the obturator withdrawn such that the tip is in a curved configuration.

[0033] FIG. 10A is a side view of a thrombectomy catheter with an extended obturator within the lumen of the catheter.

[0034] FIG. 10B is a side view of the thrombectomy catheter of FIG. 10A with a curved tip following removal of the obturator and guide structure.

[0035] FIG. 10C is a side view of an alternative embodiment of the obturator of FIG. 10A with a rapid exchange design.

[0036] FIG. 10D is a side view of another alternative embodiment with the use of an obturator of FIG. 10A with a catheter adapted for use with a guidewire extending through a slit when the catheter tip is bent.

[0037] FIG. 10E is a side view of the catheter of FIG. 10D with the obturator removed such that the tip is in its curved configuration.

[0038] FIG. 11A is a fragmentary, side view of an alternative embodiment of a thrombectomy catheter with a side aspiration hole and with an obturator configuring the catheter for delivery.

[0039] FIG. 11B is a fragmentary side view of the thrombectomy catheter of FIG. 11A with the obturator removed such that the catheter has a curved configuration.